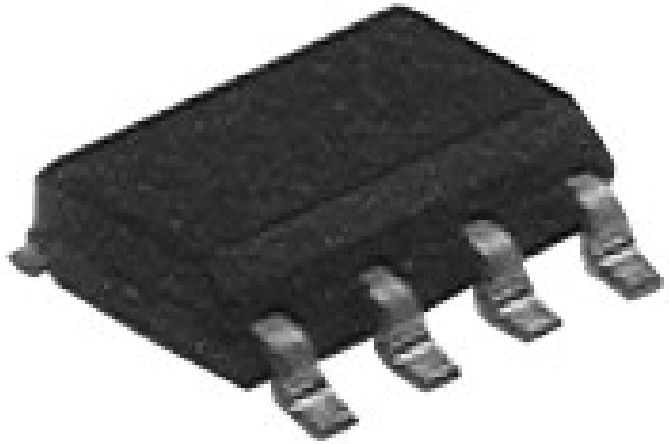
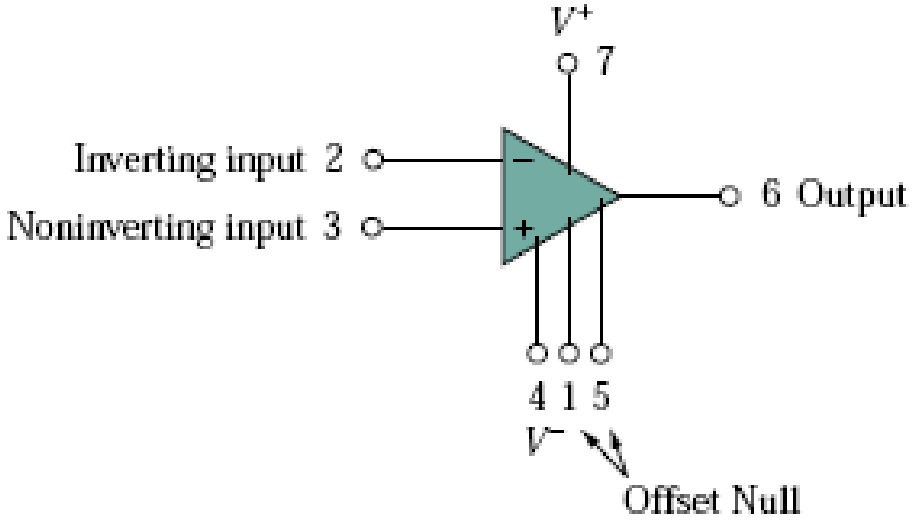
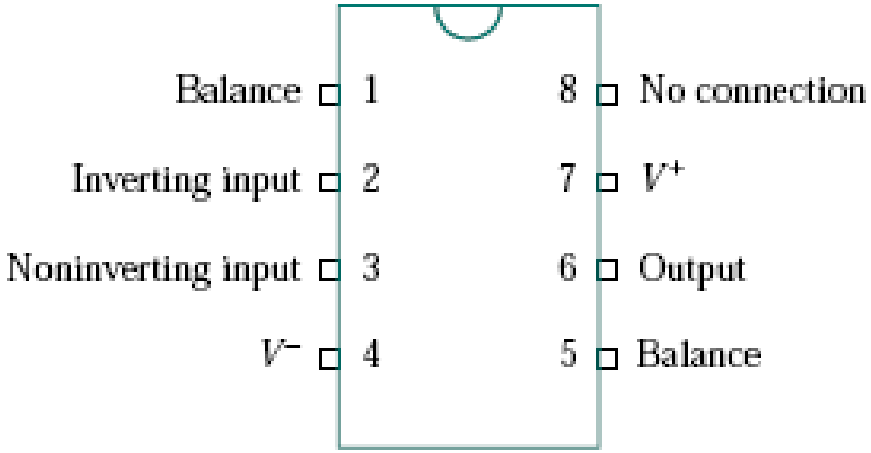
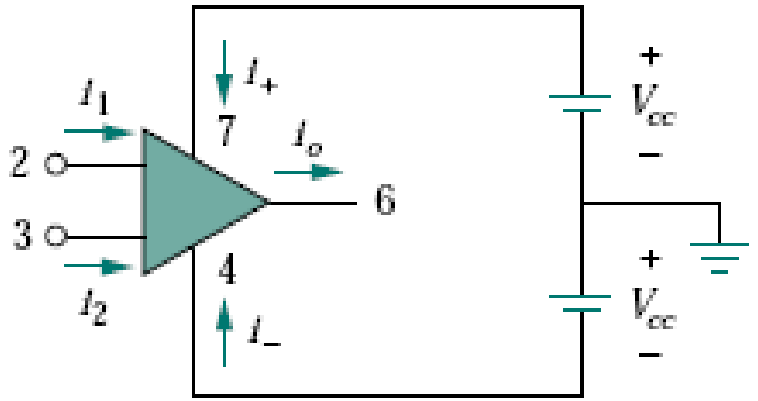
Operational Amplifier

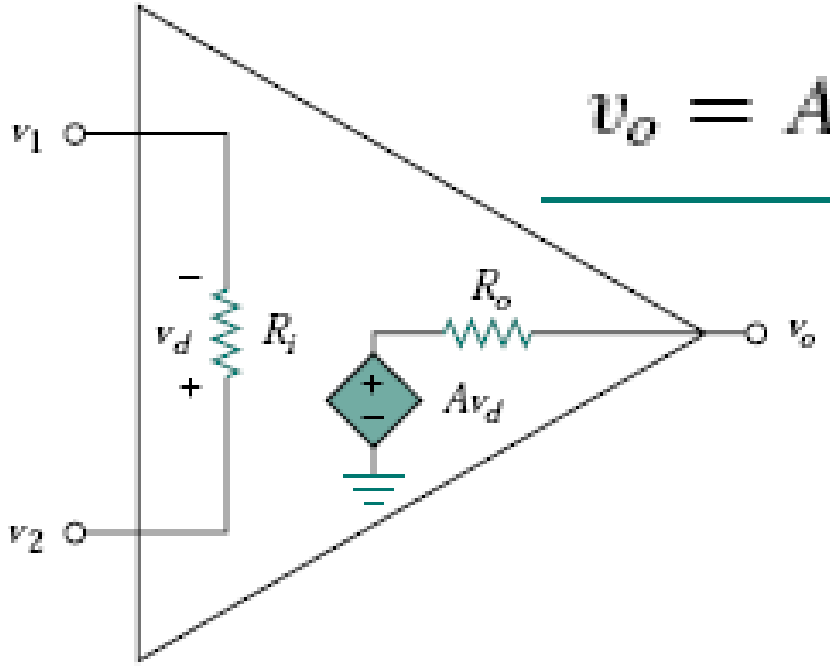






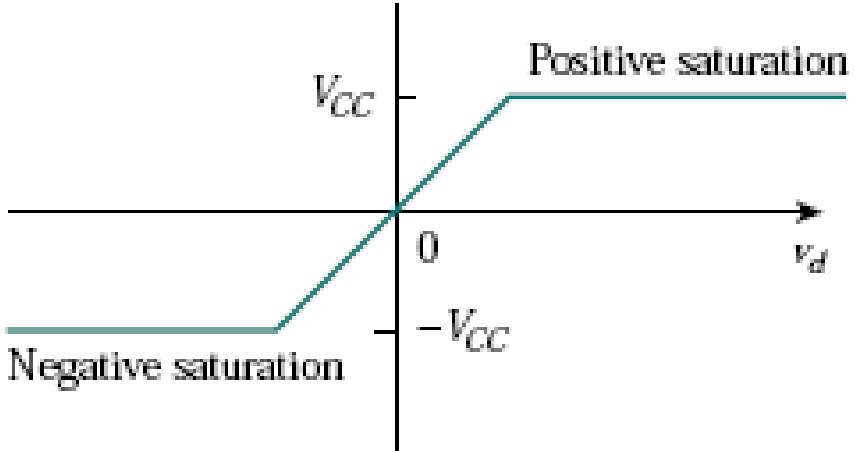


Operational Amplifier



$$v_o = Av_d = A(v_2 - v_1)$$

Parameter	Typical range	Ideal values
Open-loop gain, A	10^5 to 10^8	∞
Input resistance, R_i	10^6 to $10^{13}\ \Omega$	$\infty\ \Omega$
Output resistance, R_o	10 to 100 Ω	0 Ω
Supply voltage, V_{cc}	5 to 24 V	



1. Positive saturation, $v_o = V_{CC}$.
2. Linear region, $-V_{CC} \le v_o = Av_d \le V_{CC}$
3. Negative saturation, $v_o = -V_{CC}$.

Open Loop

Vo = (V1 - V2) x AoL

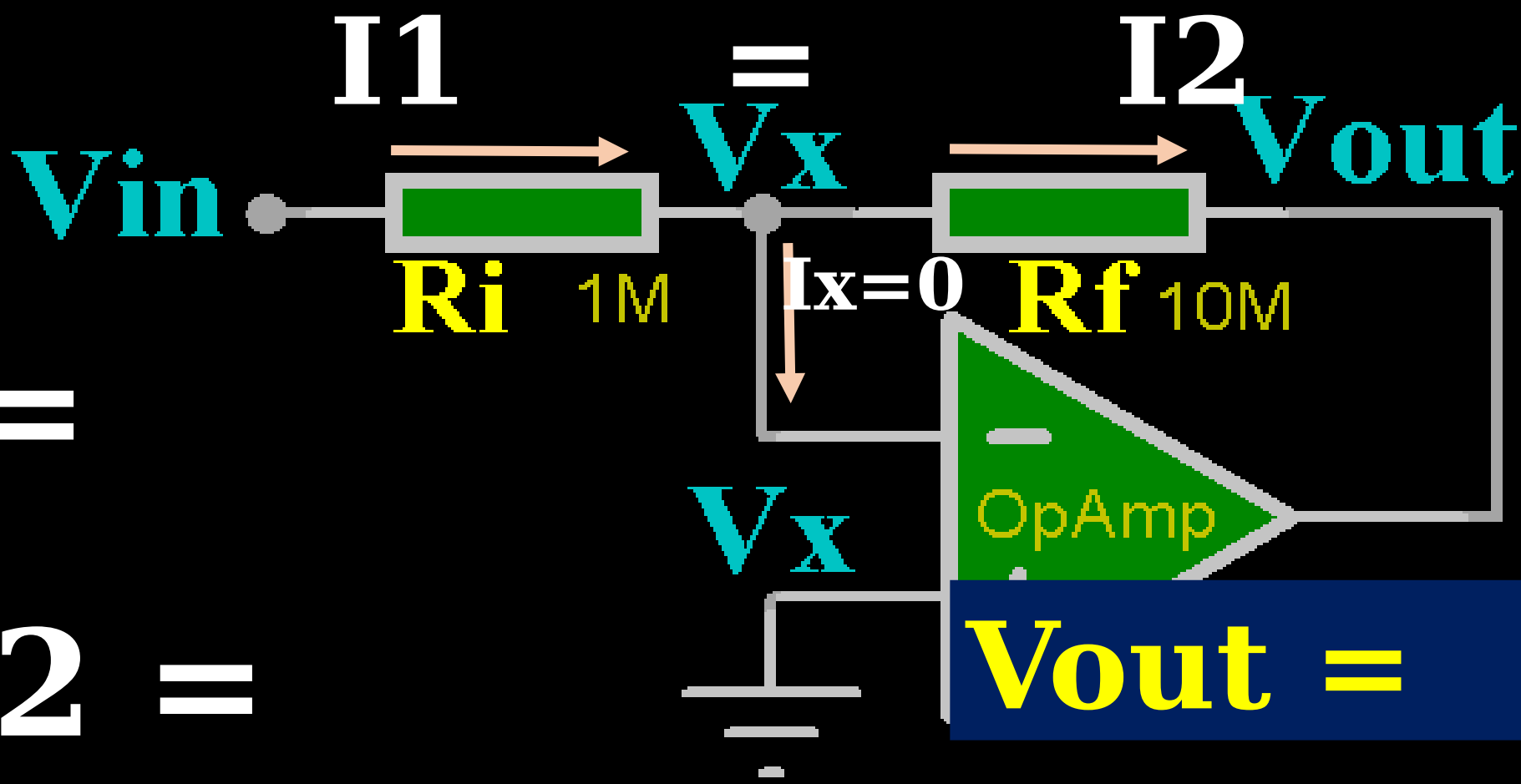
V1 - V2 = Ed = Vo/AoL

Ideal ---> AoL = ~ , Maka V1 - V2 = Ed = 0, ---> V1 = V2

Sifat-sifat OPAMP Ideal :

1. AoL = ~
2. Zin = ~
3. Zout = 0
4. Lebar bidang frekuensi (Bandwidth) = ~
5. Arus bias masukan (input bias current) = 0

Inverting Amplifier



I1 =

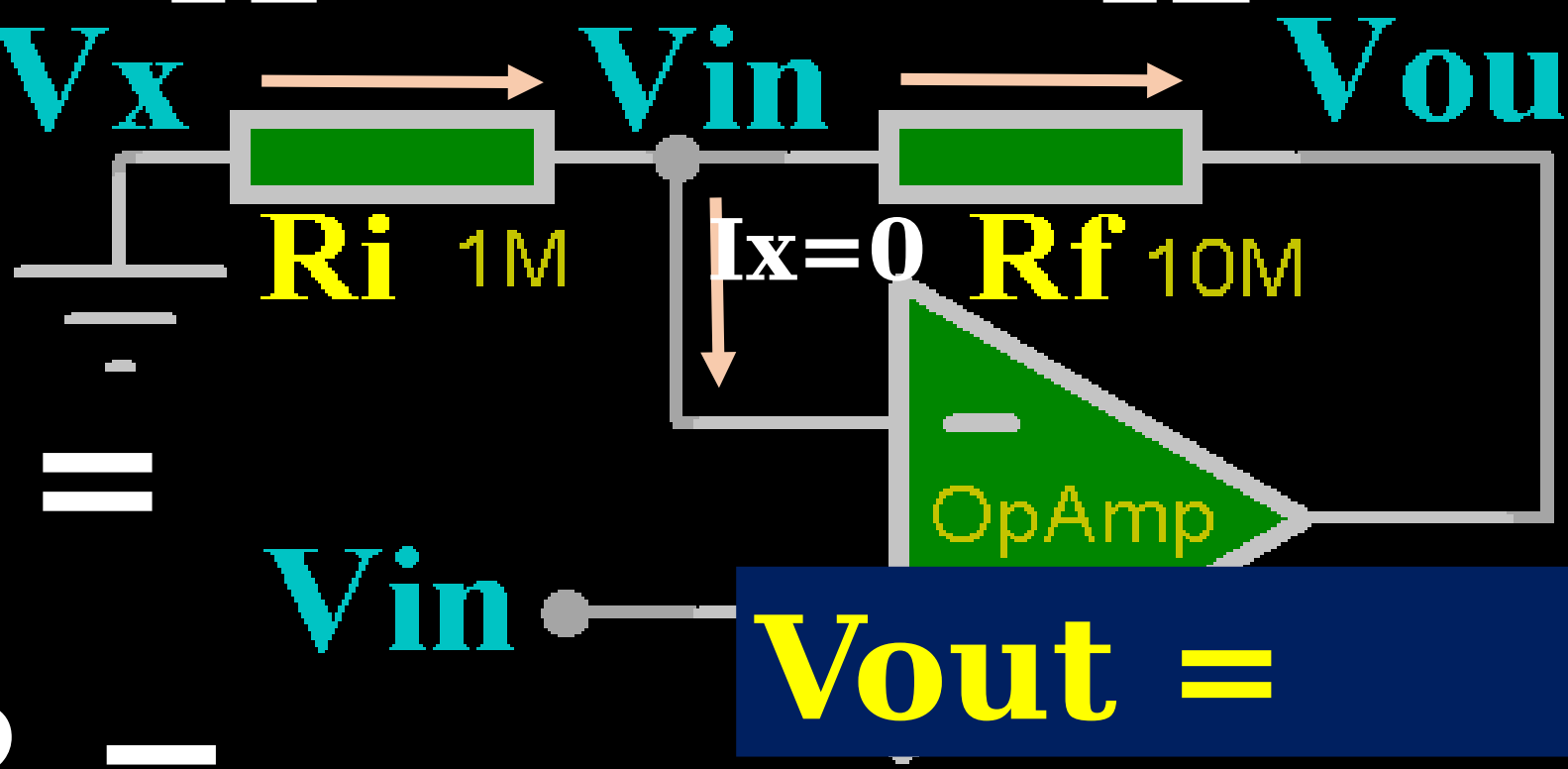
I2 =

Vout =

Karena I1=I2 dan Vx = 0 maka,

Non-Inverting Amplifier

I1 = I2



I1 =

Vin

Vout =

I2 =

Karena I1=I2 dan Vx = 0 maka

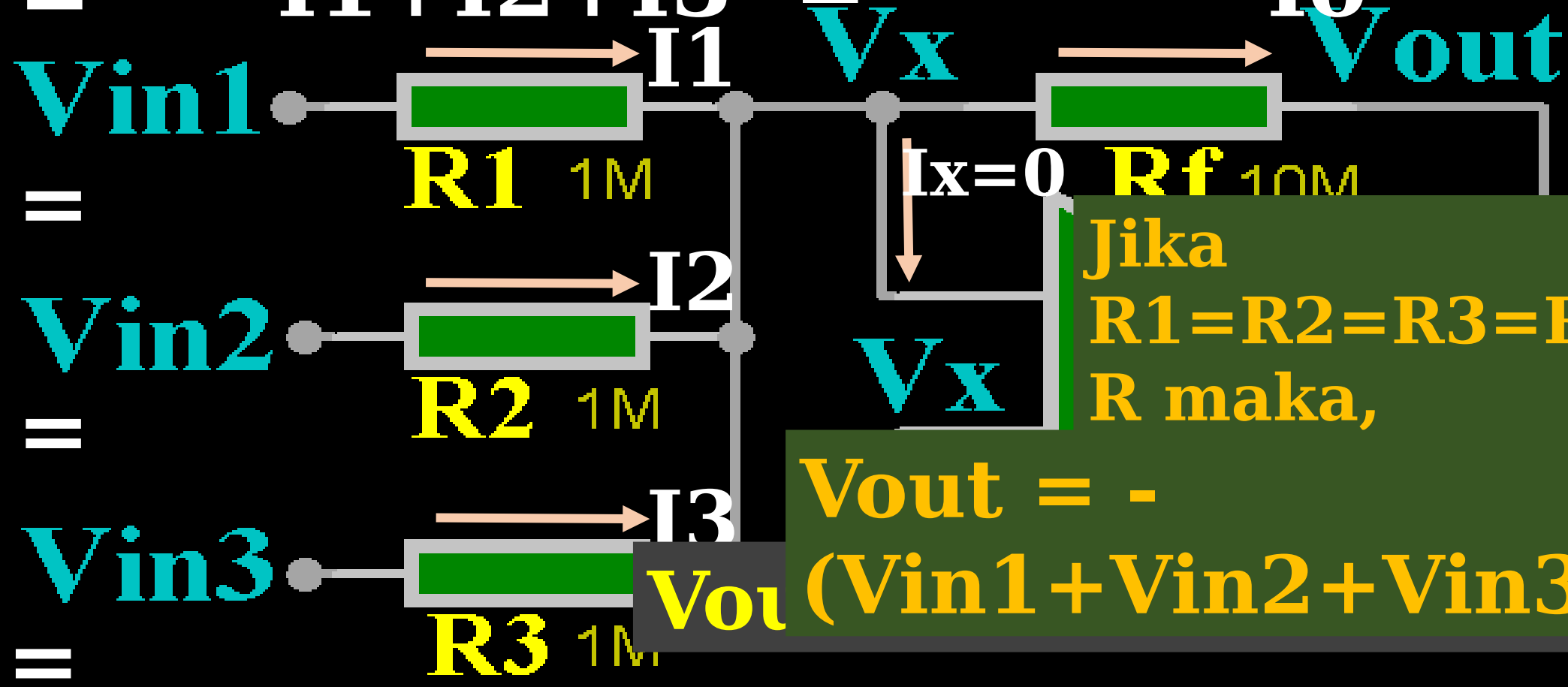
Inverting Adder

I1 = I1+I2+I3 = Io

I2 =

I3 =

Io =



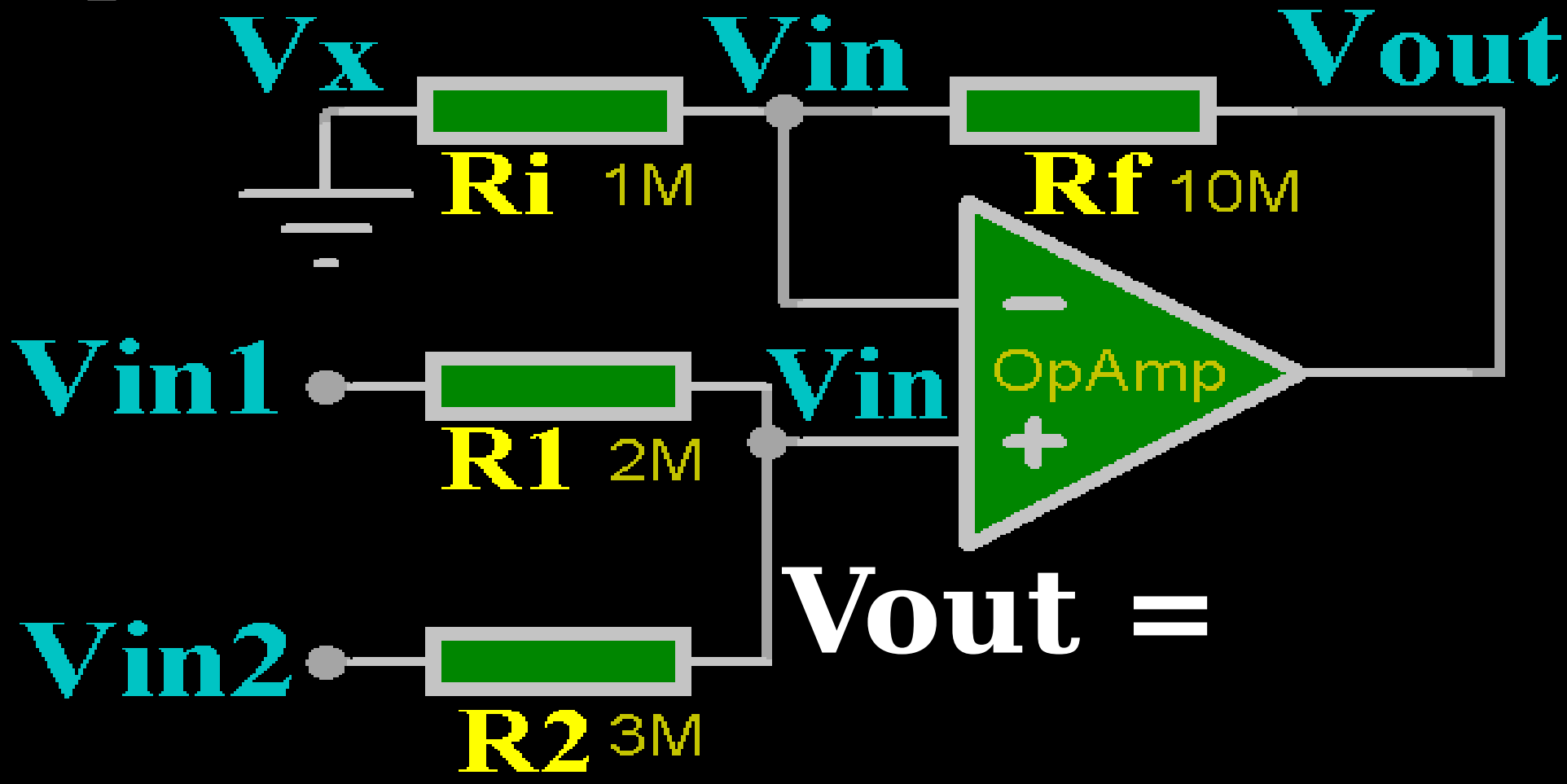
Jika
R1=R2=R3=Rf=
R maka,

Vout = -
(Vin1+Vin2+Vin3)

Karena I1+I2+I3=Io dan Vx = 0 ma

Non-Inverting Adder

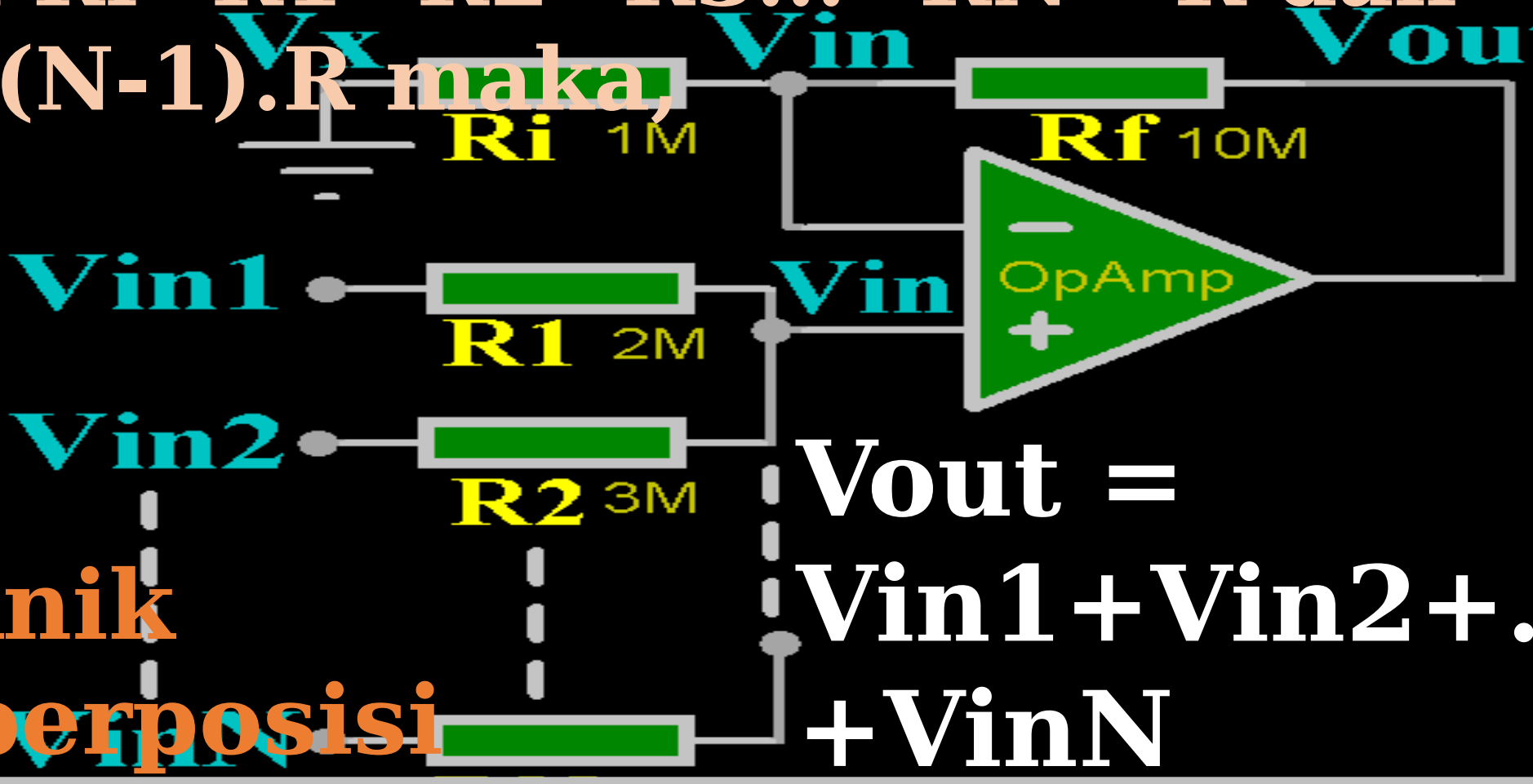
Superposisi,Vin =(Vin1) + (Vin2)



Vout =

Non-Inverting Adder N-Input

Jika Ri=R1=R2=R3...=RN= R dan Rf=(N-1).R maka,



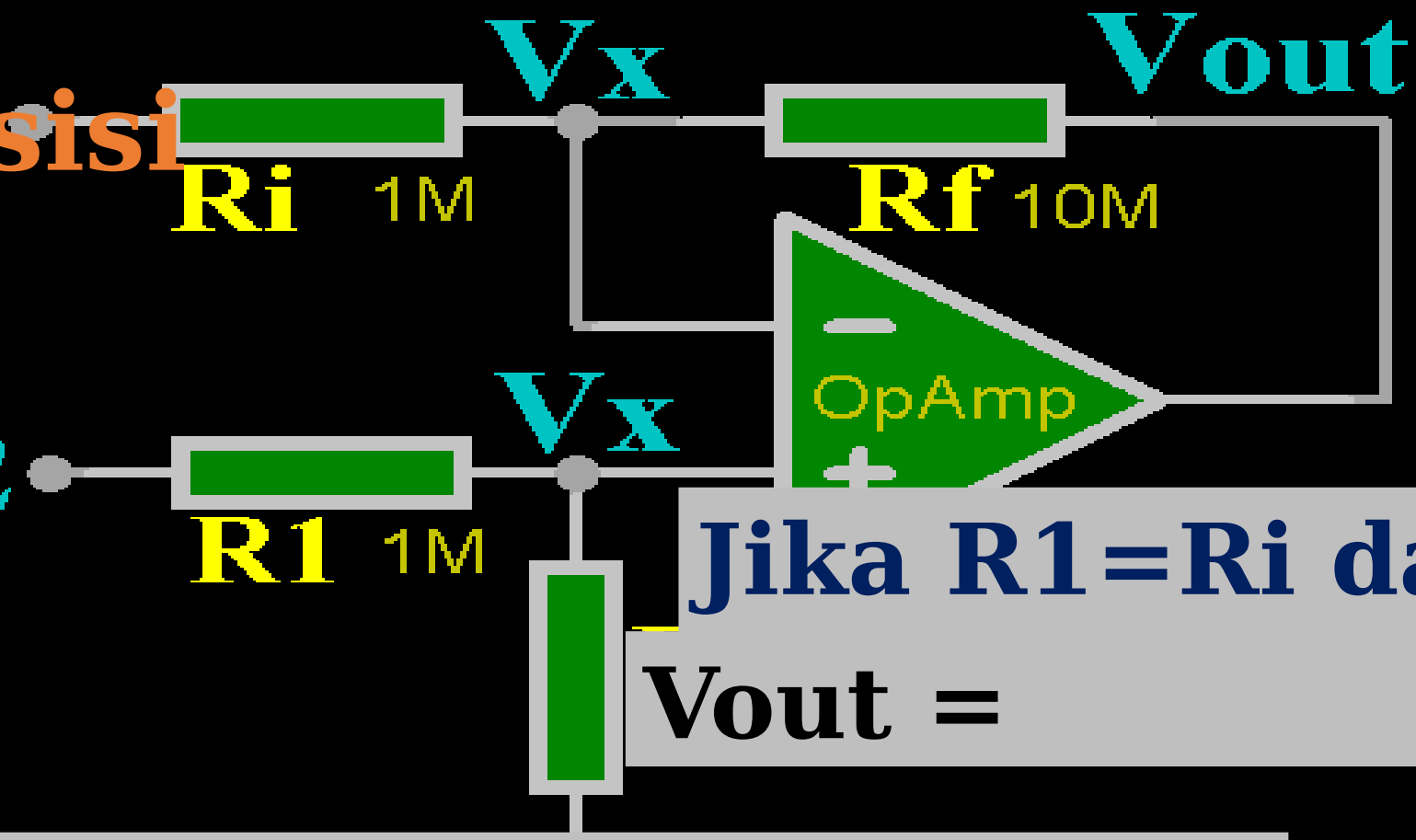
Vout = Vin1+Vin2+. . . +VinN

Teknik Superposisi

Vin=(Vin1)+. . .+(VinN)

Differential Amplifier

Teknik Superposisi



Vin1=

Vout=

Vin2=

Vout = 1

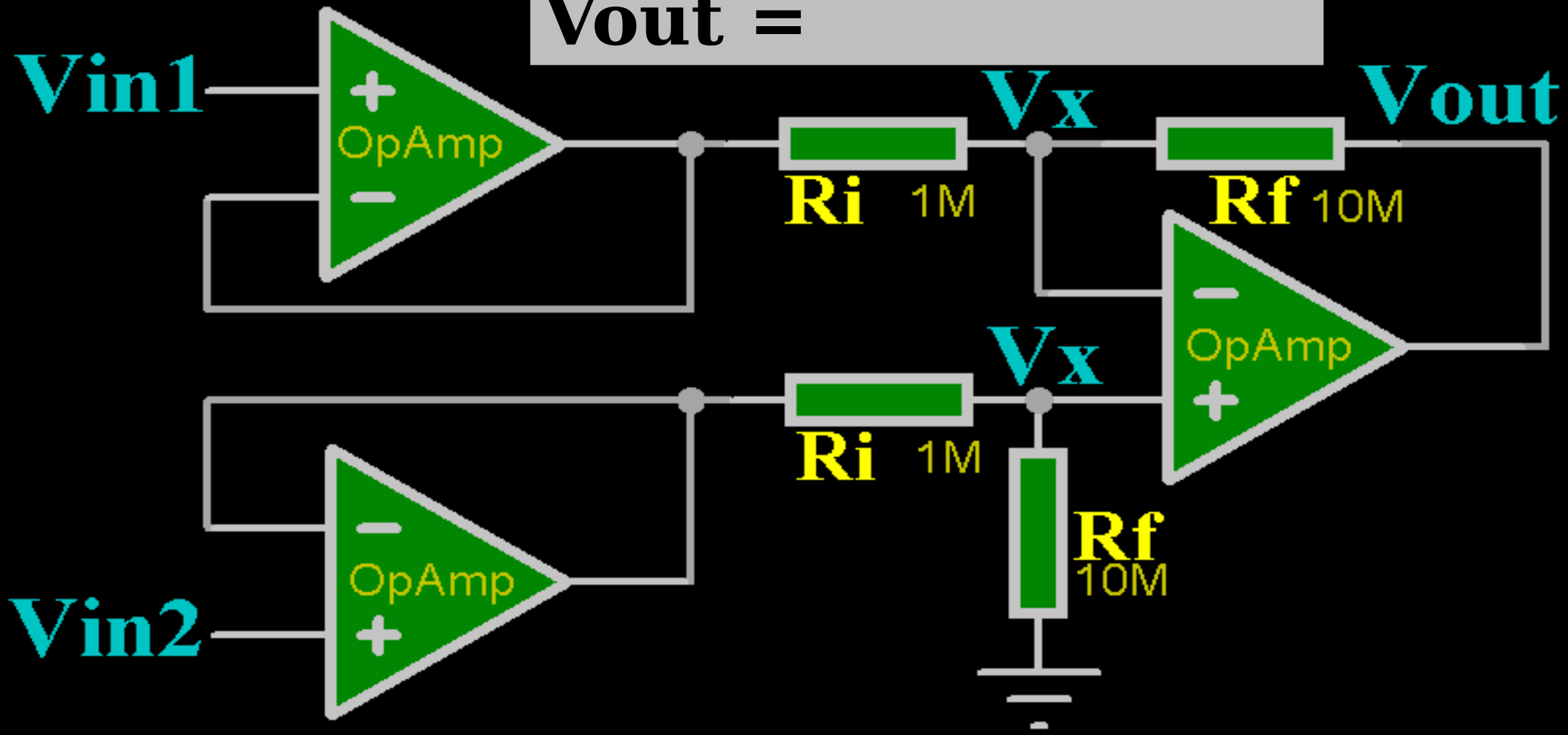
Jika R1=Ri dan

Vout =

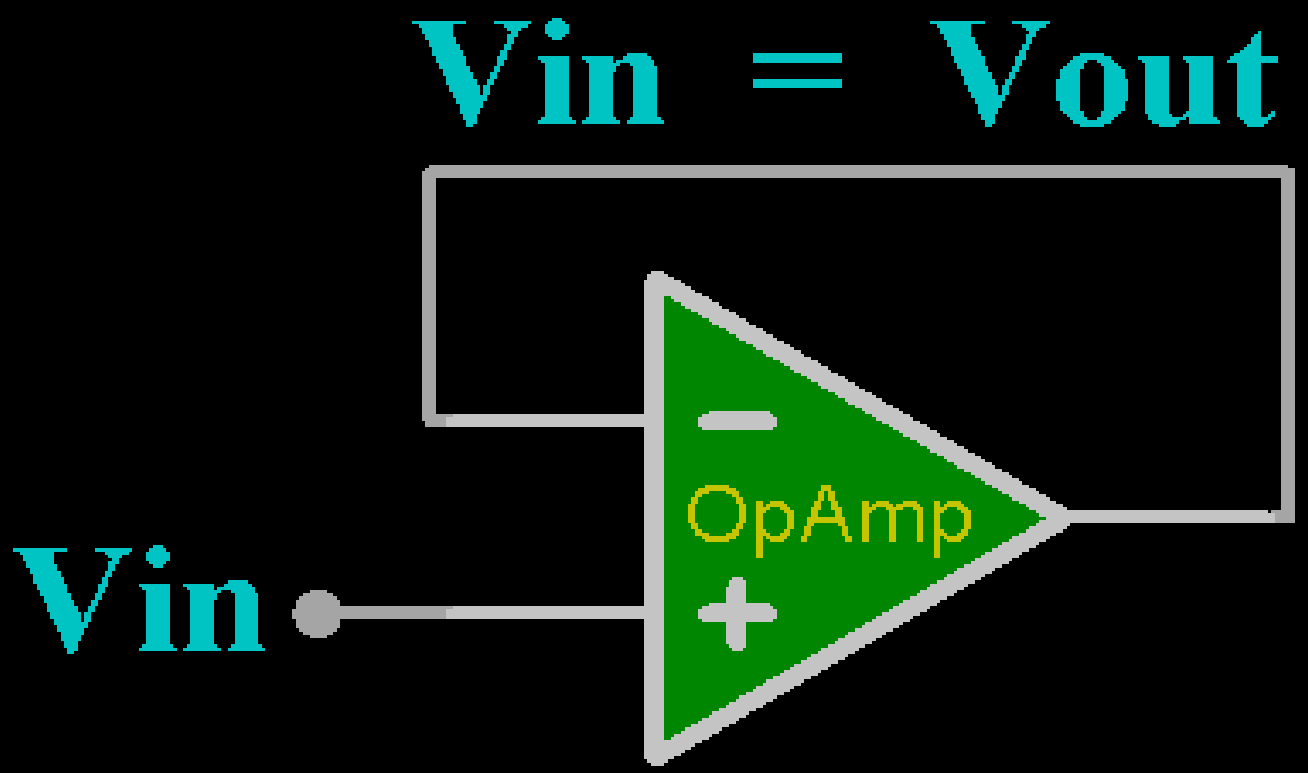
Vout =

Instrumentation Amplifier

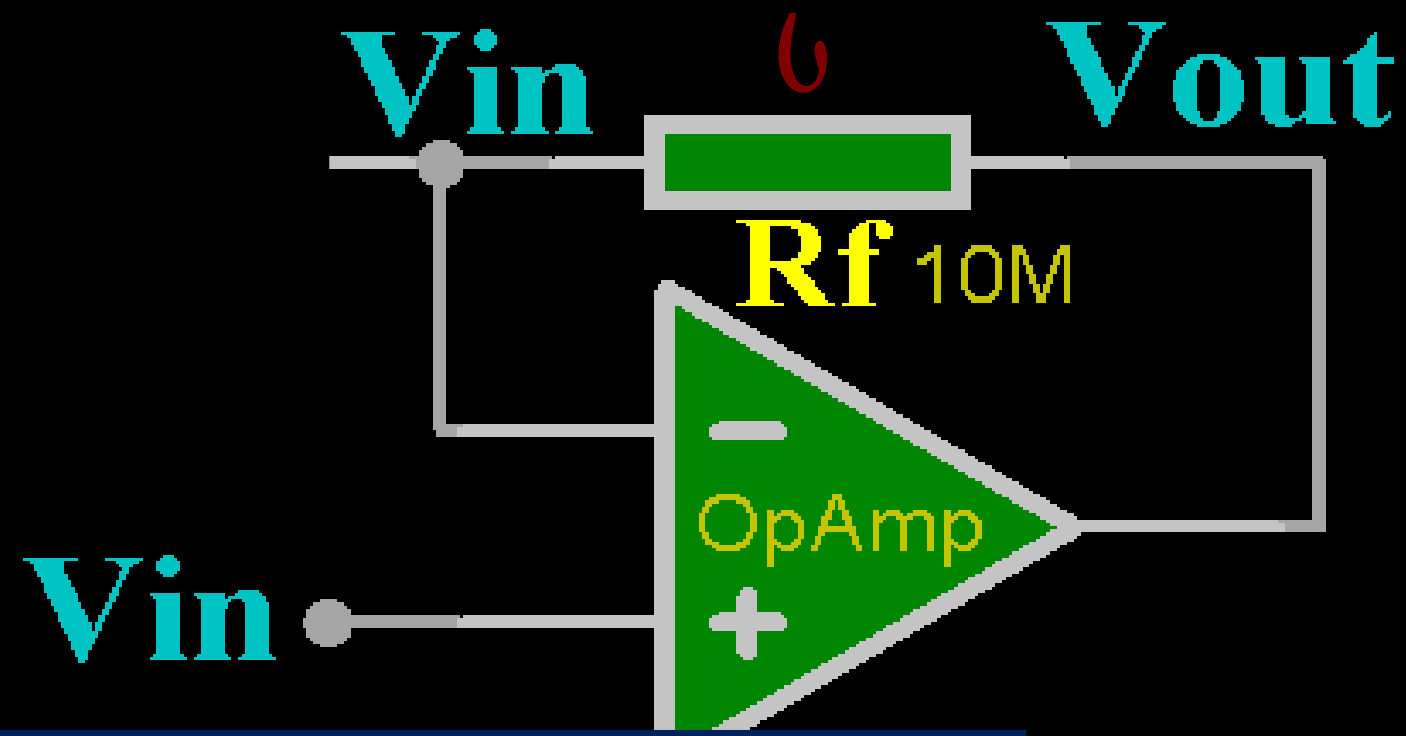
Vout =



Rangkaian Penyangga(Buffer)



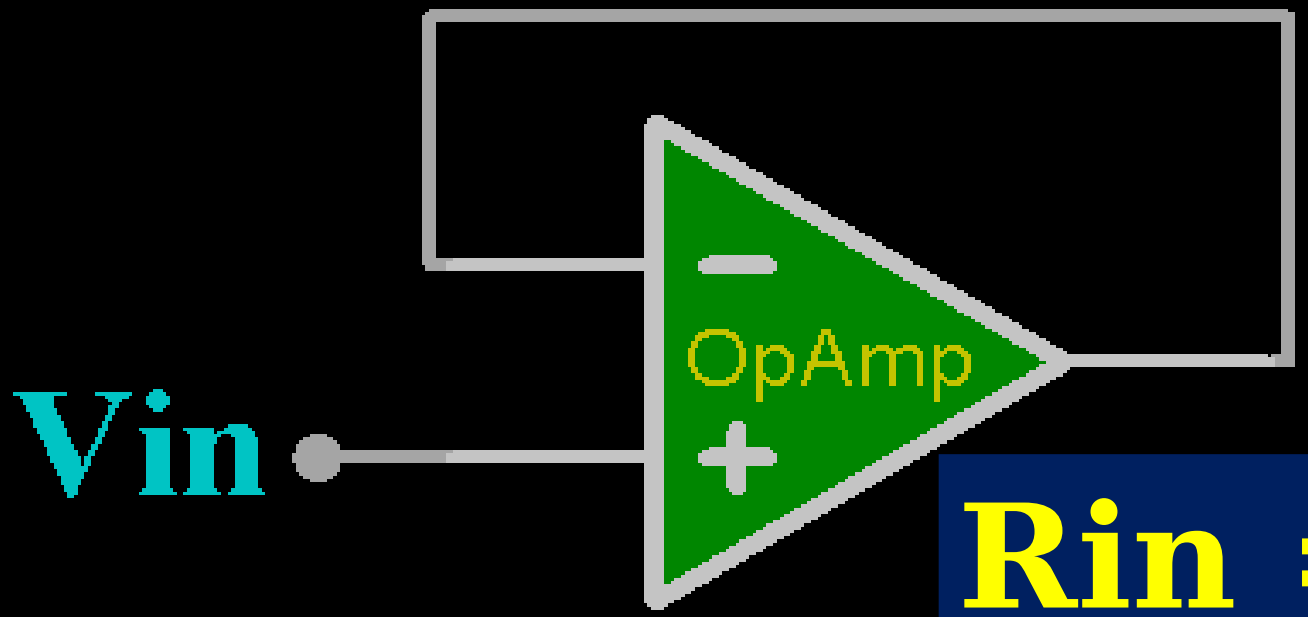
Rangkaian Penyangga (*Buffer*)



Vout =

Rangkaian Penyangga(Buffer)

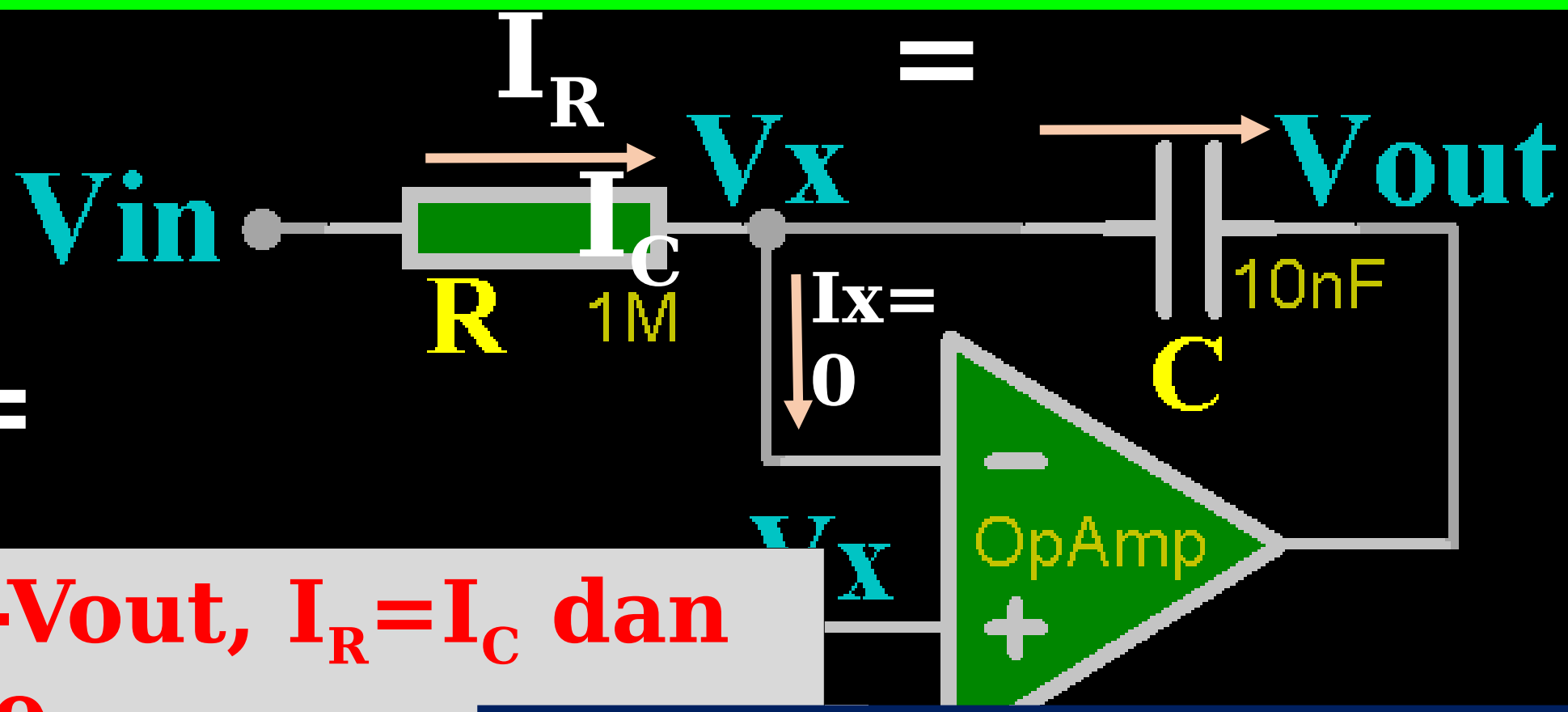
Vin = Vout



Rin = Besar

= ∞

Rangkaian Integrator



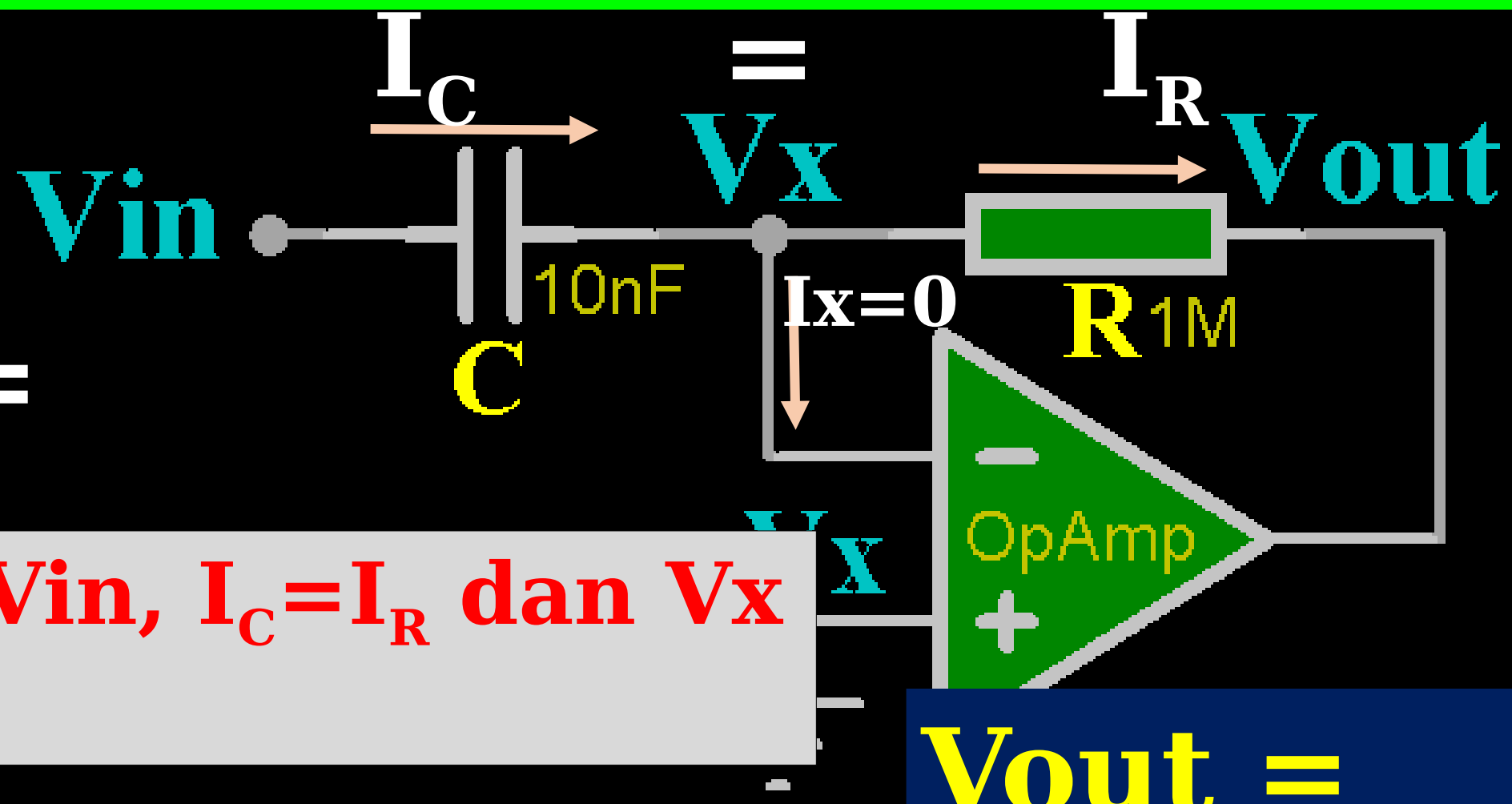
V_C = -Vout, I_R=I_C dan

Vx = 0

I_C

Vout =

Rangkaian Differentiator



$I_C =$

$= -_R$

V_C = Vin, $I_C = I_R$ dan Vx = 0

Vout =